CHAPTER FIVE: FLOOD PROBLEM ASSESSMENT

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COMMON ACRONYMS/ABBREVIATIONS USED IN CHAPTER 5

ANHMP - All-Natural Hazards Mitigation Plan

BFE – Base Flood Elevation

CRS - Community Rating System

DCEO - Department of Commerce and Economic Opportunity

DMA 2000 - Disaster Mitigation Act of 2000

DPR Planning Area – Des Plaines River Watershed Planning Area

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

FIS – Flood Insurance Study

FPA – Flood Problem Area

FPAI – Flood Problem Areas Inventory

GIS – Geographic Information System

HEC – Hydrologic Engineering Center

HMPC - Hazard Mitigation Planning Committee

IDNR-OWR – Illinois Department of Natural Resources – Office of Water Resources

IEMA – Illinois Emergency Management Agency

ISWS – Illinois State Water Survey

ITR – Independent Technical Review

LiDAR - Light Detection and Ranging

NFIP – National Flood Insurance Program

NRCS – Natural Resources Conservation Service

PB&D – Planning, Building & Development

RVR – Runoff Volume Reduction

SFHA – Special Flood Hazard Areas

SMC – Lake County Stormwater Management Commission

SMU – Subwatershed Management Unit

USACE – United States Army Corps of Engineers

USDA – United States Department of Agriculture

USGS – United States Geological Survey

WDO – Lake County Watershed Development Ordinance

WMO – Cook County Watershed Management Ordinance

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5 FLOOD PROBLEM ASSESSMENT

Floodplains and floodways along stream and river corridors perform a variety of benefits. Some of these benefits include aesthetic value, flood storage, water quality, and plant and wildlife habitat. The most important function, however, is the capacity of the floodplain to hold water during significant runoff events to minimize flood damage. Upland areas outside of the floodplains and floodways can experience urban flooding, which is common in older sections of communities where original storm sewers were not designed to present-day standards (prior to stormwater and floodplain regulations). Urbanization has increased runoff, and climate is trending to more frequent and intense storm events (Illinois Urban Flooding Awareness Act, 2015). The increased stormwater runoff, in combination with areas with inadequate and poorly maintained stormwater infrastructure, lead to flash flooding in these urbanized areas.

5.1 FLOOD EVENTS

Flooding is a problem many DPR planning area residents have experienced, whether at home, in their yard, in their neighborhood, at work, or on area roadways. As SMC compiled the Des Plaines River Watershed-Based Plan, more information was needed about when and where flooding occurs that impacts residents in the DPR planning area. As part of the watershed planning process, SMC wanted to identify structures in the watershed that are at risk of flooding so that the watershed plan can include reasonable solutions to reduce flood damage in a cost-effective manner. Throughout the watershed, overbank flooding is most extensive along the Des Plaines River with the highest recorded crest elevations occurring in 2017, 1986, and 2004. Numerous additional historical floods have occurred in the watershed and are mentioned below. The description of these floods below was obtained through various historical resources, including hydrologic atlases and flood hazard mitigation plans and reports.

5.1.1 1938

Figure 5-1: Libertyville Fire Department draining the Fould's Milling Co.
Source: Independent Register on July 8, 1938.

The 1938 flood was one of the more notable floods that occurred in Lake County. This flood seemed to have a two-pronged attack hitting areas around both Butler Lake and the Des Plaines River, which was caused by a tremendous amount of rain in a small window of time. Some residents were surprised when they left for work and found they could not reach their cars due to the flood waters. This flood was thought to have about $1 million worth of property damage and $35,000 of that came from property from Fould's Milling Co. (Hillier, 2015). The Fould's factory was located on Church St. and was right next to both the Des Plaines River and Liberty Lake. Most of the flooding damage occurred in the basement of the factory destroying thousands of dollars' worth of products (see Figure 5-1). The Libertyville Fire Department sent their truck in to help syphon out water, with many fireman and volunteers working through the night to get the basement clear again. While Fould's Milling Co. was dealing with their flood damage, Butler Lake was dealing with their own problems (see Figure 5-2). Lake County's record-setting flood of 1938 became a bit of town lore in Grayslake as the "day that fish swam down main street" (French & Associates, Ltd., 2001).

Figure 5-2: Butler Lake flooding of Lake Street
Source: Libertyville Independent Register on July 8, 1938.

The flood of 1938 wasn't the first flood in Libertyville, but it seemed to be the first that illustrated what a problem flooding could be. Officials for the town realized that something needed to happen to curtail the flooding and damage. However, no one could seem to agree on what should be done or whose responsibility it was. About 25 years later, Libertyville would have two floods in three years that were worse than their 1938 predecessor, but it would be years beyond that before any government action would take place to address the prevention of flooding.

5.1.2 1950s

In 1951, flooding occurred along Indian Creek and around Countryside Lake. The flooding along Indian Creek was reported at the time to be the highest in recent years. In July 1957, flooding occurred around Gages and Diamond Lakes and along Buffalo Creek and its tributaries, Seavey (Hawthorn) Drainage Ditch, Aptakisic Creek, and Wheeling Drainage Ditch.

5.1.3 1960s

The floods of April 1960 resulted from snowmelt followed by heavy rains which eventually overwhelmed the available floodplain storage and set new flood stage records on the Fox and Des Plaines Rivers, respectively. Flooding occurred from March-April 1960 along Mill Creek and Avon-Fremont drainage ditch, Indian Creek, Kildeer Creek (S. Branch Indian Creek), Bull Creek, North Mill Creek and Dutch Gap Canal, the Des Plaines River, and along many other small streams and lakes in the area. In April 1965, Hastings Creek and the Avon-Fremont drainage ditch flooded, as did areas around Sylvan and Forest Lakes. The 1960 flood is notable in that it spurred the first floodplain mapping effort in northeastern Illinois, undertaken by the Northeastern Illinois Planning Commission (now CMAP).

5.1.4 1986 and 1987

The 1986 flood was triggered by widespread regional rainfall with varying intensity and duration which had been preceded by two weeks of nearly continuous rain falling across northern regions of the Des Plaines River, North Branch of the Chicago River and Fox River watersheds. As a result, flooding occurred in rivers and streams across Lake, McHenry, northern Cook Counties (Juhl, 2018).

The Des Plaines River has a long history of flooding that has caused significant economic losses. The damages associated with the 1986 floods was an estimated $35 million in damages to 10,000 dwellings and 263 business and industrial sites. More than 15,000 residents were evacuated from the flooded area and seven lives were lost. Severe impacts to transportation occurred in 33 municipalities along the Des Plaines River in Lake and Cook Counties (USACE, 2014).

Figure 5-3: Des Plaines River flooding 1986

The Des Plaines River took four weeks to pass this floodwater. Northeastern Illinois received almost one inch of rain daily from September 21 through October 4; on some days, as much as three inches of rain fell. Over this two-week period, the Des Plaines River watershed received up to 12.9 inches of rain compared to the normal monthly amount of three inches. The flooding in Lake County killed four people; one person drowned when his boat capsized, and three people had heart attacks fighting the flood. A federal disaster declaration was declared by President Ronald Reagan for the region. Figure 5-3 shows the Des Plaines River flooding in 1986.

The 1987 flooding was caused by short duration high intensity storms. The flooding affected 11,500 single family units and caused $53 million in private property damage in northern Illinois.

The storms of October 2-3, 1986, and August 13-14, 1987, in Illinois, though of contrasting types, both caused record floods and stream discharges with recurrence intervals exceeding 100 years. The 1986 floods were scattered throughout northeastern Illinois and were most severe in Lake and Cook Counties in Illinois. The floods of 1987 were localized and confined to the Des Plaines River basin. Flood damages were great, leaving many residents and motoring public stranded and without access to services. The 1986 and 1987 floods generated enough public awareness of the continued problems of drainage and flooding for the Illinois General Assembly to pass legislation authorizing the formation of countrywide stormwater management programs. Such programs, in conjunction with state and federal programs, are providing stormwater management planning, watershed planning, regulation of construction within floodplain areas, and new sources of funding to manage local drainage and flooding problems.

Lake County adopted a comprehensive stormwater management plan and ordinance to address increased flooding and improve water quality. Existing development, however, is still subject to flooding. As a result, SMC in cooperation with local, state and federal agencies initiated a flood mitigation program to reduce flooding in developed areas.

5.1.5 2004

In May 2004, record to near record flooding occurred in Lake and Cook counties. Heavy rainfall and resultant runoff from the headwaters of the Des Plaines River in Kenosha County, Wisconsin brought the Des Plaines River to flood stage from the Russell to Gurnee stream gages on May 18th. Monthly average rainfall reported re between 10 and 13 inches of rain, with the Upper Des Plaines, Fox River, and Southern Wisconsin watersheds receiving around 40 percent of annual precipitation in 30 days (NOAA, National Weather Service 2004). Floodwaters inundated large areas in Lake County Illinois. The area along the Des Plaines River from Russell to Gurnee stream gages suffered the worst flood problems. Floodwaters inundated large areas of low lying farmland near Russell and surrounded some houses as well. Many residents were evacuated from their homes as flood waters continued to rise. Approximately 40 homes and 20 businesses were affected by high water in Gurnee with 35 homes evacuated. Gurnee area schools were closed. Flood waters surrounded Viking School and the Gurnee Grade School during the peak of the flooding, but sandbagging efforts helped prevent any major flood damage. Many major roads were impacted by flooding and at one time only 4 east-west roads were open from the Wisconsin state line down to Gurnee. Figure 5-4 shows the sandbagging efforts of the Gurnee Grade School in Gurnee during this storm event.

Figure 5-4: Flooding at the Gurnee Grade School

5.1.6 2008

In 2008, multiple storm events associated with the remnants of Hurricane Ike led to 51 consecutive hours of precipitation in Northeastern Illinois. The largest rainfall accumulations occurred south of Lake County but resulted in a disaster declaration for Lake and other surrounding counties for these storms and flooding.

5.1.7 2013

In 2013, a massive rainstorm on April 17-18, 2013 delivered between 4-7 inches of rainfall to Northern Illinois (NOAA National Weather Service, 2014). The late snow melt and heavy rains in early April combined with the two-day rain event on April 17-18th, 2013 resulted in extended, widespread riverine flooding in the Des Plaines River watershed. Major flood stage, as defined by the National Weather Service is "extensive inundation of structures and roads." On April 19th, 2013, the Des Plaines River at

Figure 5-5: April 2013 flood event in Grandwood Park
Flooding damage to the Grandwood Park Dam

Lincolnshire stream gage reached peak water level of 16.36 feet setting a record. The peak water level near Gurnee reached 11.32 feet, just shy of the record 11.95 feet set in 1986. (USACE, 2017).

The heavy rains overwhelmed storm and sanitary sewer systems, caused sewer backups, localized and riverine flooding throughout the County. Floods damaged an estimated 3,200 properties, forced evacuations, and caused numerous power outages and road closures. In Lincolnshire, a levee was breached requiring 49 homes to be evacuated. In Buffalo Grove, the basin at Buffalo Creek Forest Preserve overtopped the dam and Buffalo Creek discharge increased to record levels causing substantial erosion and habitat loss. In response to flooding and severe storms, President Obama declared that a major disaster exists in the State of Illinois. This declaration made federal disaster assistance available for Individuals and Public Assistance. In Lake County, 1,159 individuals and/or households received upwards of $2.7 million dollars in federal disaster assistance. Figure 5-5 shows the April 2013 flood event damage to the Grandwood Park District Dam and the surrounding flooding.

5.1.8 2017

Figure 5-6: Flooding in downtown Mundelein

Torrential rounds of heavy rain began late on the night of July 11th, 2017 and continued into the morning of July 12th 2017. Multiple rounds of rain continued over the same locations produced 3-7 inches of rain which brought flash flooding by daybreak and continued throughout the entire day and into the next night. Flooding occurred, and at times very rapidly, affecting flood-prone areas as well as communities that had not experienced this type of flooding before. The heavy rain overwhelmed stormwater infrastructure and the rapid rise of several feet of water along the Des Plaines River led to widespread flooding in the southern portion of the watershed. Major roads were closed, and residents in several areas were evacuated. Hundreds of homes and properties sustained major damage and another 3,000 homes had less severe damage. Record crests were recorded for the Des Plaines River at the Gurnee, Lincolnshire, and Russell Road stream gage locations. Flood waters in many locations along the river did not recede for several days after the rain began. Three Illinois counties including Lake County were proclaimed disaster areas by Governor Bruce Rauner, however federal assistance for a major disaster declaration was denied because the total amount of flood damages did not meet the state threshold for federal assistance. Figure 5-6 shows the extent of flash flooding that occurred in downtown Mundelein during the July 2017 storm event.

5.1.9 June 2015 Illinois Urban Flooding Awareness Act Final Report

In August 2014, the Illinois General Assembly through PA98-0858 tasked the IDNR to prepare a report on the extent, cost, prevalence, and policies related to urban flooding (Illinois Urban Flooding Awareness Act, 2015). In addition, IDNR was tasked to identify resources and technology that may lead to mitigating the impacts of urban flooding. Flooding in urban areas has received increasing attention in the last decade, with at least $2.319 billion in documented damages between 2007 and 2014, of which $1.240 billion were private claims that typically represent basement flooding and sewer backup (Illinois Urban Flooding Awareness Act, 2015). The Urban Flooding Awareness Act requires FEMA to direct a study to quantify these facts and develop recommendations to assist federal, state, and local governments in their efforts to prevent and provide relief from urban flooding to homeowners and businesses across the country. The Urban Flooding Awareness Act specifically identifies the following nine topics to be addressed in the report:

1. Prevalence and costs associated with urban flooding events across the state and the trends in frequency and severity over the past two decades.
2. Apparent impact of global climate change on urban flooding.
3. The impact of county stormwater programs on urban flooding over the past two decades, including a list of projects and programs and the flood damages avoided.
4. An evaluation of policies such as using the 100-year storm as the standard for designing urban stormwater detention infrastructure and the 10-year storm for the design of stormwater conveyance systems.
5. Review of technology to evaluate the risk of property damage from urban flooding and whether a property is in or adjacent to a 1% (100-year) floodplain or not, including LiDAR and GIS.
6. Strategies for minimizing damage to property from urban flooding, with a focus on rapid, low-cost approaches such as nonstructural and natural infrastructure, and methods for financing them.
7. The consistency of the criteria for state funding of flood control projects between IDNR, IEMA, and DCEO.
8. Strategies for increasing participation in the NFIP and Community Rating System (CRS).
9. Strategies and practices to increase the availability, affordability, and effectiveness of flood insurance and basement backup insurance.

5.2 FLOOD PROBLEM AREAS INVENTORY

5.2.1 FLOOD AND STORMWATER QUESTIONNAIRE

As part of the watershed planning process, SMC identified structures in the watershed that are at risk of flooding so that the watershed-based plan can include reasonable solutions to reduce flood damage. In February 2016, SMC mailed 6,946 hard copies and over 1,500 emails of the voluntary flood and stormwater questionnaire. Recipients were made up of DPR planning area stakeholders in SMC's contact database and known flood problem area residents. The flood and stormwater questionnaire was also accessible to the public through SMC's website and was publicized at the March-May 2016 Des Plaines River watershed planning meetings. The flood and stormwater questionnaires were collected and summarized in May 2016.

The flood and stormwater questionnaire results can help address watershed flooding issues and needs by providing information for residential and business flood damage and flood history. The flood questionnaire focused on characteristics of the landowner's property (i.e., type of property, foundation, basement, water supply, etc.), types of insurance, flood history (possible sources of historical flooding, flood damage, frequency), flood mitigation measures, and other flooding or stormwater management issues in their community.

SMC received 237 completed questionnaires to summarize (without any address specific data) and use for flood mitigation planning purposes in the watershed assessment and action plan. The results of the flood and stormwater questionnaire indicated that 44% of the respondents said flooding was a concern and 30% of respondents said drainage was a concern. 80% of the respondents that indicated they have flooded said they are located in a floodplain. The top three causes of flooding specified by stakeholders are multiple causes, overbank flooding, and storm sewer backup. Stakeholders identified flood damage reduction and maintaining infrastructure as a high priority by category. Flood problem area information was obtained through some of the received questionnaires and included in the overall FPAs inventory. See Figure 5-7 for flood questionnaire results on the types of flooding identified in the DPR planning area.

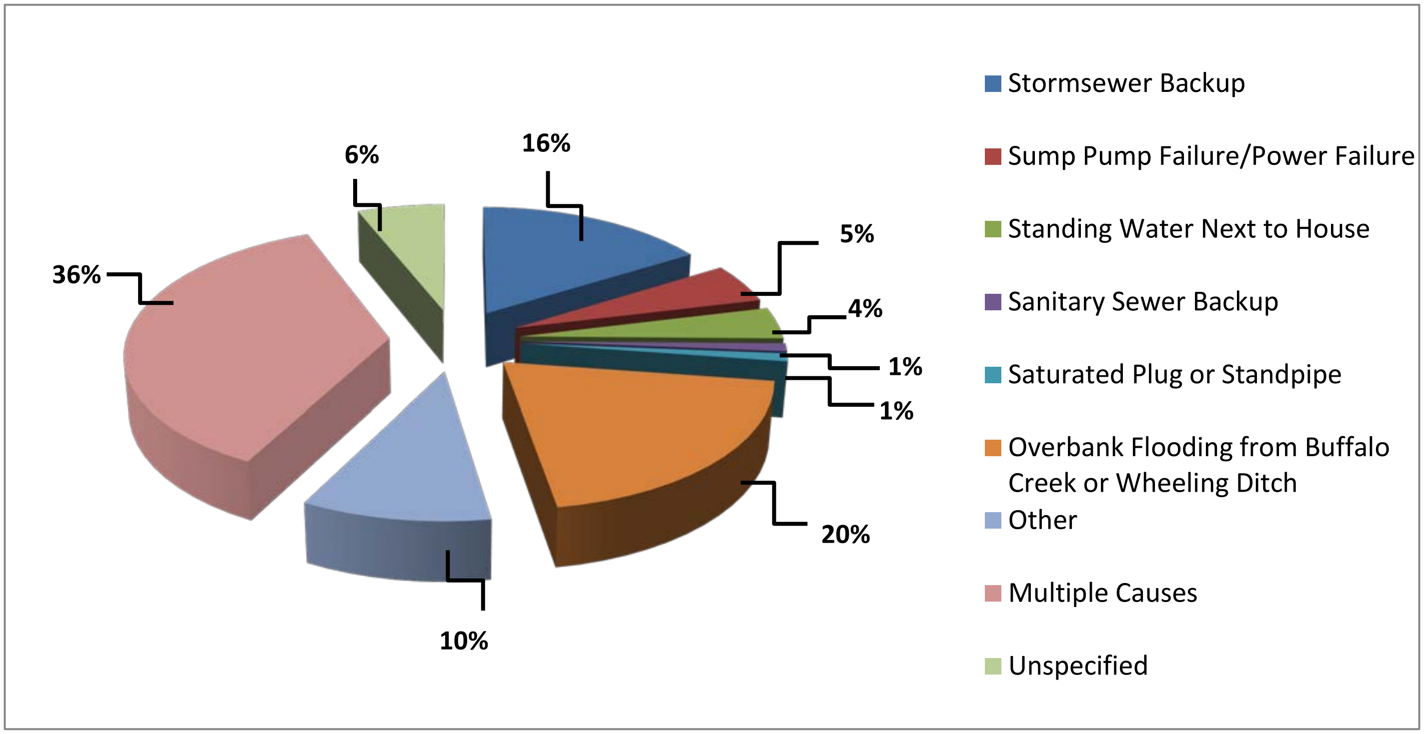


Figure 5-7: Causes of flooding identified from the Flood and Stormwater Questionnaire

5.2.2 Characterization of Flood Problem Areas

Flood Problem Area (FPA): One or more structures in a geographical area that are damaged by the same primary source or cause of flooding. Structures include transportation, utility infrastructure, buildings, and well and septic failure caused by flooding. Areas also include locations where road flooding results in damage to infrastructure, loss of critical access, or threatens safety.

SMC conducted the countywide Flood Problem Areas Inventory (FPAI) in 1995-1996 and updated it in 2002. The FPAI, and a flood risk assessment based on mapped floodplains, identified structures that have been or may be damaged by flood events that are less than the 100-year event. The FPAI is used to locate flood damage problem areas based on reports of flood damage by residents or communities. The FPAI identifies the primary cause of flood damage for each area and is used to recommend flood mitigation priorities. The flood risk assessment identifies additional locations where structures occur in mapped floodplain areas and are likely at risk of flood damage. The purpose was to identify those structures that are at risk of flooding so that the plan can recommend ways to reduce flood damage.

As part of the watershed planning process, SMC updated the inventory of local FPAs to identify the sources of flooding, improve opportunities for reducing flood damage, aid decision-makers about determining adequate downstream capacity when issuing development permits in proximity to FPAs, and reduce flood damage at existing sites from nearby development projects. In March 2016, SMC mailed and emailed 44 watershed municipalities, townships, and large jurisdictions the current flood problem area map and information forms for their jurisdiction to provide updated or new flood problem information. The FPAI information was collected and summarized in April 2017; 30 jurisdictions responded to this inventory update with updated and new information.

Before starting the Des Plaines River watershed planning process, 149 FPAs were known in the DPR planning area. As a result of this FPAI update, SMC received updates on 32 known FPAs, removed 12 locations (flood mitigation efforts were implemented), and added 77 new FPAs to the inventory. Currently, there are 214 known FPAs in the DPR planning area (see Figure 5-8); this number does not include all of the flood data collected from the July 2017 flood event. Because the FPAI includes many areas affected by storms less than the 100-year event, the July 2017 flood event data is excluded given the larger magnitude of that particular storm.

5.2.2.1 July 2017 Flood Event FPAs and Critical Facilities

From July 11-12, 2017 a major precipitation event resulted in rainfall amounts between 3.4 and 7.2 inches in Lake County causing substantial flooding. SMC, Lake County PB&D, and local municipalities surveyed impacted areas to identify FPAs, impacted properties, and impacted critical facilities using data from resident self-reporting and the IEMA. SMC defined FPAs as areas that experienced flooding during the event. FPAs varied in size, with some impacting one property and others impacting over 100 properties. Critical facilities are areas that may require a special response because of human needs or potential environmental impacts, including daycares, schools, gas stations, nursing homes, long term care facilities, and similar facilities. SMC identified 486 FPAs that impacted 2,233 properties and 46 critical facilities within the Lake County portion of the DPR planning area (Figure 5-8). The July 2017 flood event identified FPAs overlapped with approximately 29 existing FPAs in the DPR planning area.

During the survey, structure damage from flooding and multiple forms of flooding were observed, including sewer backups; street, yard, and driveway flooding; and structure flooding. Table 5-1 summarizes the number of FPAs, impacted properties, and impacted critical facilities for each type of flooding. This flood impacted multiple municipalities within the DPR planning area, with Grayslake, Gurnee, Libertyville, Mundelein, and Warren Township having the largest number of impacted properties (Table 5-2). From this event, IEMA received over 3,500 flood damage assessment form entries, and an estimated 9,553 structures were adversely affected by the storm events in Lake County, Illinois.

Table 5-1: DPR Planning Area FPAs, impacted properties, and impacted critical facilities by type of flooding

TYPE OF FLOODING	NUMBER OF FPAS	NUMBER OF IMPACTED PROPERTIES	NUMBER OF IMPACTED CRITICAL FACILITIES
Sewer Backup	14	15	1
Street/Yard/Driveway Flooding	75	75	3
Structure Flooding	378	2,124	41
Structural Damage from Flooding	19	19	1
Total	**486**	**2,233**	**46**

Table 5-2: DPR Planning Area FPAs, affected properties, and impacted critical facilities by municipality

MUNICIPALITY	NUMBER OF FPAS	NUMBER OF IMPACTED PROPERTIES	NUMBER OF IMPACTED CRITICAL FACILITIES
Antioch	3	3	0
Avon Township	3	3	0
Beach Park	3	3	0
Buffalo Grove	11	25	1
Ela Township	1	1	0
Fremont Township	11	19	0
Grayslake	61	353	12
Green Oaks	7	7	0
Gurnee	73	182	1
Hainesville	1	2	0
Hawthorn Woods	8	8	0
Lake Villa Township	13	41	0
Lake Zurich	1	1	0
Libertyville	45	530	6
Libertyville Township	14	62	0
Lincolnshire	2	8	0
Lindenhurst	17	49	2
Long Grove	16	18	2
Mettawa	4	6	0
Mundelein	64	443	8
Newport Township	5	48	0
Park City	2	2	0
Riverwoods	9	10	0
Round Lake Beach	9	13	1

MUNICIPALITY	NUMBER OF FPAS	NUMBER OF IMPACTED PROPERTIES	NUMBER OF IMPACTED CRITICAL FACILITIES
Third Lake	5	29	0
Vernon Hills	17	38	1
Vernon Township	10	30	1
Wadsworth	4	4	0
Warren Township	54	272	11
Waukegan	11	19	0
Waukegan Township	1	3	0
Zion	1	1	0

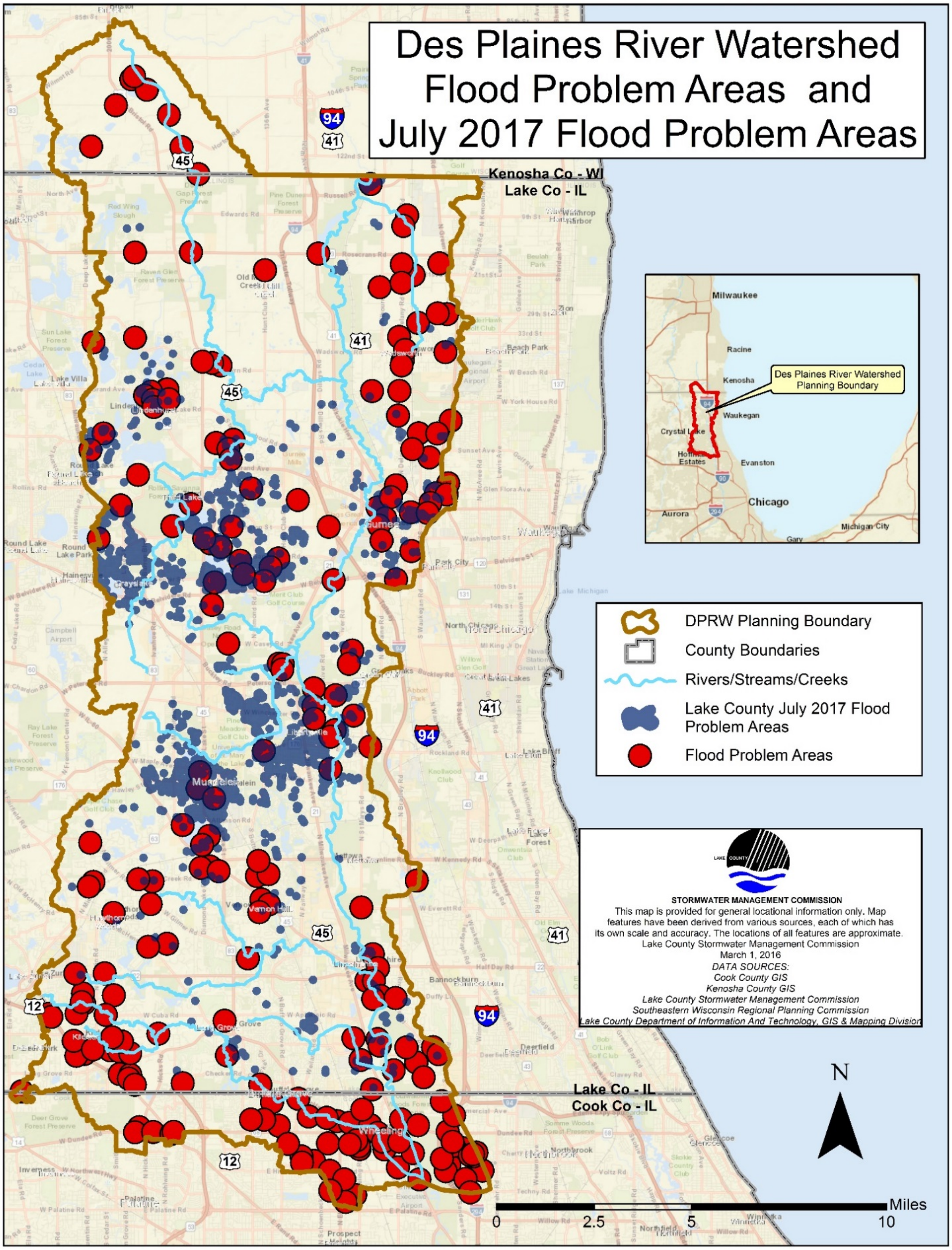


Figure 5-8: Des Plaines River Watershed FPAs and July 2017 flood damage assessment map

5.3 FLOOD RISK ASSESSMENT – STRUCTURES IN THE FLOODPLAIN

Flood risk areas are Special Flood Hazard Areas (SFHA) where structures have been identified as being at risk for flood damage because they are located in the 100-year floodplain. SMC compared the revised floodplain maps with recent (2015) aerial photographs to locate structures in the floodplain. All structures located within the 100-year floodplain are shown in Figure 5-9. Many of the identified structures are in or near potential FPAs. An estimated 4,911 structures (schools; churches; businesses; and residences, including garages, sheds, and gazebos), are at risk of flooding due to their location in the **100-year floodplain**. Of the 4,911 structures, approximately 4,564 properties are within the 100-year floodplain.

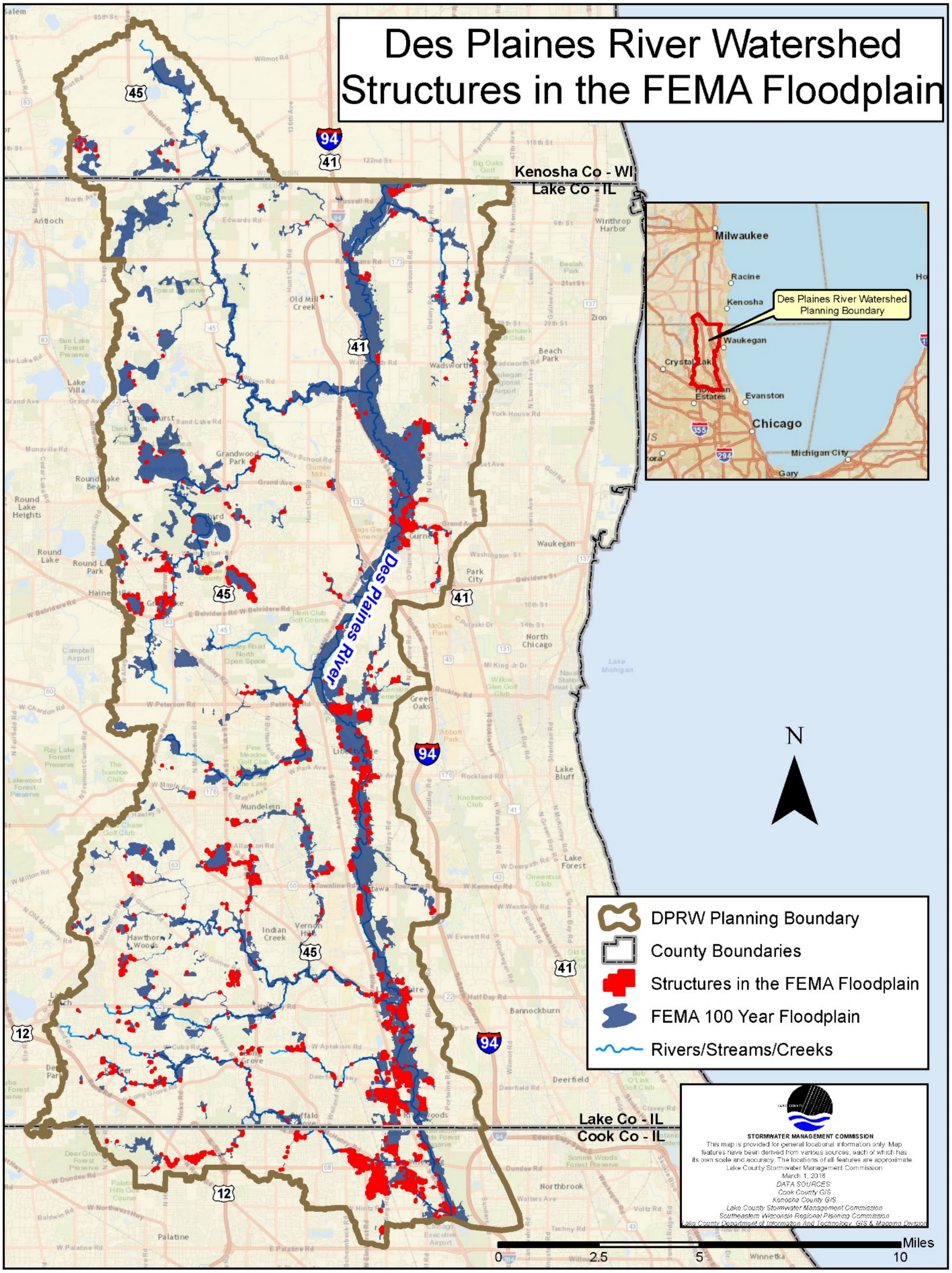


Figure 5-9: Des Plaines River Watershed Structures in the FEMA Floodplain

5.4 FLOODPLAIN STUDY SUMMARY

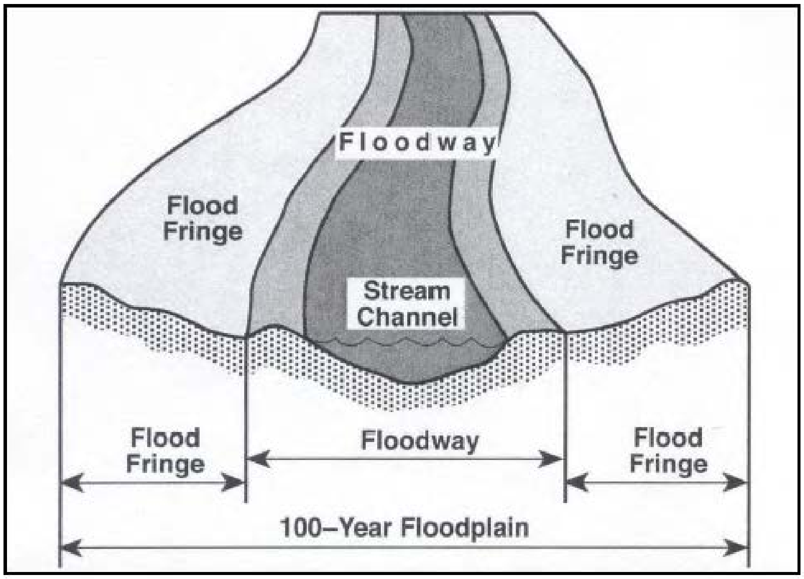


Figure 5-10: Graphical representation of the typical floodplain and floodway

Hydrologists assign statistical probabilities to different size floods to characterize common, less likely, and severe floods for individual streams. For example, a 2-year flood event has a 50% probability of occurring in any year, and a 100-year flood has a 1% chance of being equaled or exceeded in any year. The 100-year flood event, also referred to as the "base flood," is the standard used by the NFIP to determine the need for flood insurance. The 100-year flood event has become the accepted national standard for floodplain regulatory purposes and was developed in part to guide floodplain development that lessens the damaging effects of floods. The **100-year floodplain** may also include a designated floodway. The floodway is the portion of the stream or river channel that must be reserved to discharge the base flood without increasing the water surface elevation more than 0.1-foot. A graphic representation of a typical floodplain and floodway is shown in Figure 5-10.

FEMA has conducted **Flood Insurance Studies** (FIS) that assess a watershed's **hydrology**, land use, and drainage characteristics to identify areas that have the highest probability of flooding. FIS are used to produce **Flood Insurance Rate Maps** (FIRM). These maps depict the probable extent of the floodplain during a 100-year flood event. The FIRM are used to determine flood insurance requirements and calculate insurance costs. The maps are also used in concert with local, state, and federal ordinances to regulate development and building protection requirements within and adjacent to floodplain areas. The DPR planning area covers approximately 150,361 acres, and approximately 14% of the watershed is inundated during the 100-year flood event. Figure 5-11 reflects the regulatory floodplain boundary based on the effective FIRM.

Prior to the Countywide FIS, multiple communities located within the Des Plaines River Watershed completed hydrologic and **hydraulic** analyses. The pre-Countywide FIS studies were included in FIS studies from approximately 1979 to 1980.

FLOOD INSURANCE STUDY (FIS): Studies conducted by FEMA to determine areas that have the highest probability for flooding.

HYDROLOGY: Hydrology is the study of the occurrence, circulation, distribution, and properties (e.g., quality) of Earth's water.

HYDRAULICS: Hydraulics is the study of how water flows over the land surface. This includes flows within sewers, culverts, stream channels, wetlands, lakes, impoundments, etc.

FLOOD INSURANCE RATE MAP (FIRM): A map prepared by FEMA that depicts the SFHA within a community. The FIRM includes zones for the 100-year and 500-year floodplains and may or may not depict Regulatory Floodways.

The USACE updated the hydrologic and hydraulic analysis for the Des Planes River for FEMA in the September 2000 Flood Insurance revision. The work performed by the USACE was completed in September 1995. The updated study included corrections to nomenclature and planimetric information such as corporate limits. The limits of the DPR study are bound by Lake Cook Road at the southern limit of the county and extends north to approximately 0.8 miles north of Russel Road. Hydrologic data was based on USGS gaging stations. The gage data was analyzed utilizing a log-Pearson type III distribution, following guidelines recommended by the U.S. Water Resources Council. The USACE completed an analysis of the DPR frequency discharge curves for the four main stem recording gages within the study reach. The results were calibrated to match the statistical results using the HEC-1 hydrologic model. Currently, there are three floodplain studies in the DPR planning area for Newport, Bull Creek, and Mill Creek watersheds. Table 5-3 contains more information on the DPR planning area watershed floodplain studies and the status of data for usage as regulatory “best available”.

Table 5-3: Floodplain Studies in the DPR Planning Area and Status of Data for Usage as Regulatory "Best Available"

FLOODPLAIN STUDIES	CONTRACTOR	INDEPENDENT TECHNICAL REVIEW (ITR)	ITR COMPLETED?*	SMC ADOPTED?**	IDNR/ FEMA REVIEWED?	STATUS
Newport	MWH Global	Hey & Associates	Yes	No	No	Bleck Engineering has made comments on study.
Bull Creek (Des Plaines)	USGS / FluidClarity	Hey & Associates	Yes	No	No	ITR completed comments and incorporated in final Fluid Clarity study. Model updated after ITR review.
Mill Creek	Tetra Tech	Bleck Engineering	Yes	No	Flows Certified	ISWS completed revisions/waiting on Grayslake for possible additional revisions (Status: 5/2014).

* can be recommended for use as regulatory best available (where BFEs are higher than FEMA's)
** can be required for use as regulatory best available (where BFEs are higher than FEMA's)

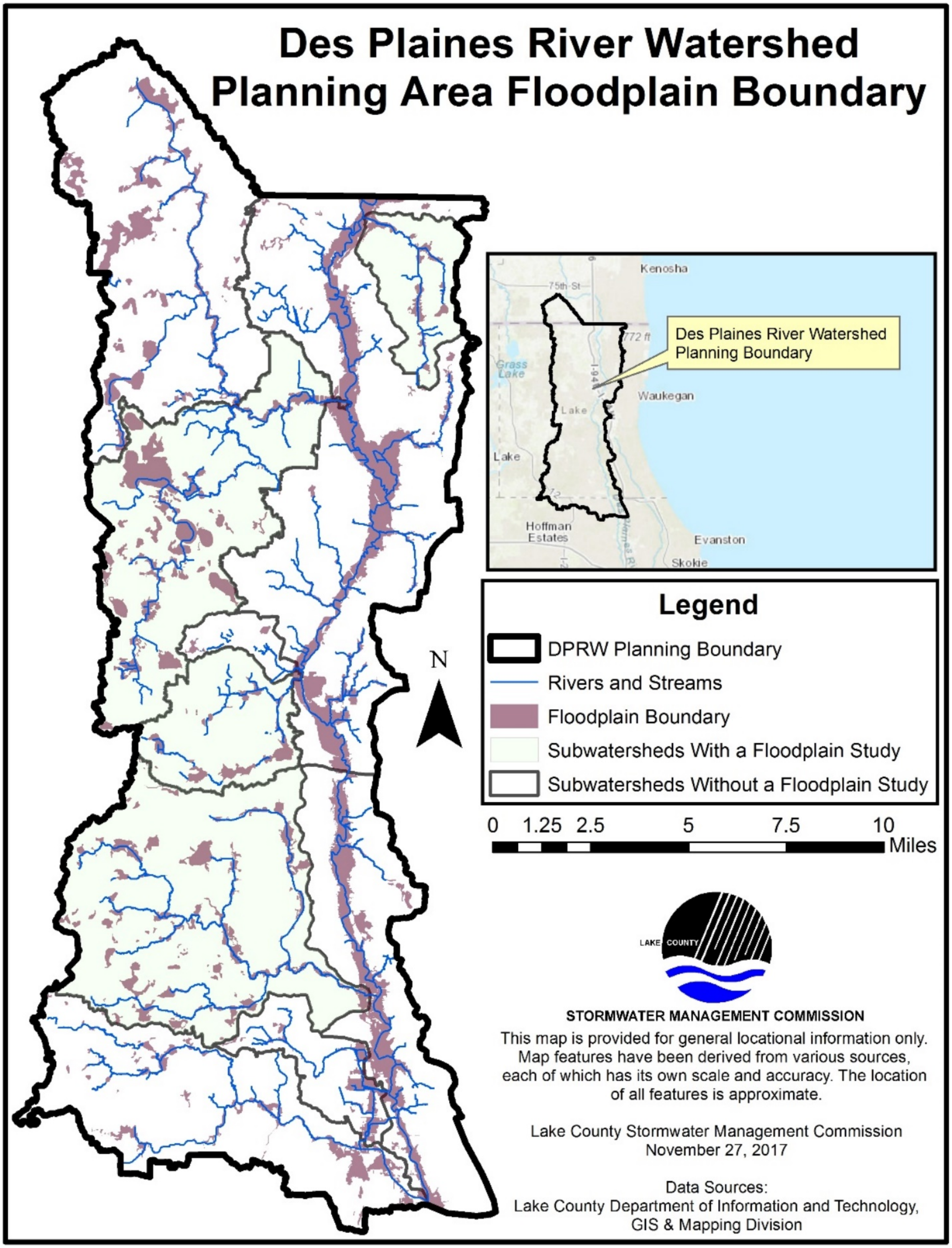


Figure 5-11: Des Plaines River Watershed Planning Area Floodplain Boundary

5.5 FLOOD DAMAGE REDUCTION

Flooding is a common issue in the DPR planning area because of urban development and a relatively flat regional topography. Urban development has increased impervious surfaces and modified or built in natural storage and floodplain areas, resulting in increased stormwater runoff volumes and rates. The relatively flat topography of the region results in excess water dispersing over a large area. Protection of the existing flood storage capacity of the landscape, including depressional areas, wetlands, and floodplains, is necessary to prevent increased flood risks in the region. Flood damage reduction is necessary to reduce the extent, frequency, and impact of flooding where development has already occurred. Flood damage reduction can be accomplished utilizing preventative or remedial measures.

5.5.1 Preventative Measures

Flood prevention techniques, including zoning, regulation, land acquisition, and runoff reduction, seek to prevent flooding problems before they occur. Zoning and floodplain regulations seek to prevent flood damages by limiting development in areas where flooding is most likely to occur. Land acquisition maintains open space, preserving rainfall infiltration and natural storage areas. Runoff reduction techniques reduce flood damage potential at the source by decreasing the amount of runoff from a developed site. This is accomplished by reducing on-site drainage, minimizing impervious surfaces, and implementing natural drainage measures.

5.5.1.1 Floodplain Zoning

Zoning ordinances regulate development by dividing the community into zones or districts and setting development criteria for each district. Zoning can prevent increased flood risks by controlling where new development or redevelopment occur. Zoning ordinances can establish separate zoning districts or overlay zoning. Separate districts designate floodplains as a special zoning districts that only allow development that is not susceptible to flood damage, such as some recreational uses, conservation, or agriculture. Overlay zoning adds special development limitations to the underlying zoning (i.e., residential, commercial, industrial, etc.) in areas subject to flooding. Special development limitations can include local, state or federal building requirements related to flood safety and can restrict the types of development occurring in overlay zoning districts or require additional permitting or oversight in these districts.

5.5.1.2 Floodplain Regulations

Regulations that restrict construction in floodplains are usually found in one or more of the following documents: subdivision ordinances, building codes, and separate stand-alone floodplain ordinances such as the Lake County WDO, Cook County WMO, and Wisconsin's local (municipal) floodplain ordinances. If the zoning for a site allows a structure to be built, then the applicable subdivision and building regulations impose construction standards to protect buildings from flood damage and will require compensatory storage to prevent the development from aggravating the flooding problem. Subdivision ordinances specifically govern how land will be subdivided into lots and regulate standards for infrastructure provided by the developer, including roads, sidewalks, utilities, stormwater detention, storm sewers, and drainage ways. Both building codes and the countywide and local ordinances establish flood protection standards for all structures. Individual communities can adopt floodplain regulations that are more restrictive than the minimum WDO, WMO, or NFIP requirements.

All development in Lake County floodplains requires a WDO permit. The WDO restricts development in mapped floodways and limits development in the 100-year floodplain. Lowest floor elevations (including basements) must be a minimum of 2 feet above the BFE for residential structures constructed in the floodplain. Nonresidential structures must also meet these lowest floor elevation requirements or be dry-flood-proofed to 2 feet above the BFE, and compensatory storage must be provided for water storage lost due to floodplain fill at a ratio of 1.2:1 for riverine floodplain and 1:1 for depressional floodplain. All Lake County communities must adhere to the standards required in the WDO as minimum development requirements for their community. Individual communities can adopt floodplain regulations that are more restrictive than the minimum requirements of the WDO. Since the WDO applies to both new developments and redevelopment projects, the WDO flood prevention and water quality provisions have the potential to improve conditions in redeveloped areas.

Cook County communities must adhere to the standards required in the WMO as minimum development requirements for their community. All development in a **Flood Protection Area** requires a Watershed Management Permit. The WMO restricts development in mapped floodways and limits development in the 100-year floodplain. Compensatory storage must be provided for floodplain storage lost due to floodplain fill at a ratio of 1.1:1.

FLOOD PROTECTION AREA: Regulatory floodplains, regulatory floodways, riparian environments, wetlands, and wetland buffers.

Wisconsin floodplain development is managed through local floodplain ordinances. All local floodplain ordinances must meet the minimum requirements of the NFIP. Floodplain ordinances are adopted at the local level in the same manner as any other ordinance. Enforcement of the floodplain regulations is the responsibility of local officials. For most communities, the responsible official is the Zoning Administrator. Every community that participates in the NFIP must have the FIRMs and FIS available for the public. Communities that do not adequately enforce the local floodplain ordinance can be penalized by FEMA through probation or suspension from the NFIP. Violations of the minimum requirements of ch. NR 116 can result in enforcement action by the WI DNR. Development and redevelopment in Wisconsin within the entire Des Plaines River Watershed (including outside of the DPR planning area) can affect stormwater drainage coming into Lake & Cook County, Illinois. See section 4.1 for more information about the effects of impervious surfaces and development to downstream sites.

5.5.1.3 Floodplain Property Acquisition

Floodplain property acquisition is one of the flood mitigation tools used by Lake County to abate the potential increase in flood risk, including the implementation of the Lake County WDO and Comprehensive Planning to protect against new flood damages. Floodplain property acquisitions ensure that buildings in a flood-prone area will cease to be subject to damage. Acquisitions are usually undertaken by a government agency, using a combination of state, local and federal (FEMA) cost-share funding to reduce the financial impact to the property owner. Properties acquired are cleared of buildings and structures and returned to public open-space areas such as parks, greenways, recreational trails, river access points, and wildlife habitat corridors. The resulting open space from acquisitions and demolition of property in the floodplain and flood-prone areas can also be used for stormwater management and/or serve as a buffer to protect against damage from increased flooding and stormwater runoff. Floodplain property acquisitions provide the best long-term flood protection measure and coverts problem areas into a community asset.

5.5.1.4 Runoff Reduction

Runoff reduction can be accomplished utilizing techniques that improve infiltration, site design, or stormwater regulation. Improved infiltration techniques include natural landscaping with deep-rooted plants, permeable pavers or porous pavement, and bio infiltration devices. Improved site design techniques include preserving natural drainage systems, impervious surface reduction, alternative streetscapes that reduce and infiltrate runoff, alternative parking lot designs, and green roofs.

Stormwater regulations can also reduce the quantity of runoff from developments. Due to a trend of increasing Runoff Volume Reduction (RVR) requirements of the Illinois EPA, both the WDO and WMO have adopted both qualitative and quantitative RVR provisions. The WDO is a credit-based system designed to capture a percent of the annual rainfall event to the maximum extent practicable. The WMO is tied to the first inch of runoff from the impervious area of a development site, defined as the control volume. These measures will decrease the volume and flow rate of stormwater that is discharged off a site thereby preventing future flood damage.

NOTEWORTHY – LAKE COUNTY WDO REGULATIONS

The Lake County WDO defines adequate downstream stormwater capacity as a system that can be shown to "store or convey up to and including the 100-year stormwater runoff without increasing damage to adjoining properties or to a point downstream known to the Enforcement Officer to be a restriction causing significant backwater."

5.5.2 REMEDIAL MEASURES

Flooding problems are reduced or eliminated by both structural and non-structural means. Structural flood mitigation measures focus on reducing the probability of flooding (i.e., removing or reducing the ability of flood waters to reach a property or structure) while nonstructural flood mitigation measures focus on reducing the consequences of flooding (i.e., flood-proofing a structure located in the floodplain.)

Structural flood mitigation measures include improving overland flow routes, increasing storm sewer capacity, and implementing other conveyance-related drainage improvements. Improved conveyance practices should be designed to ensure that adjacent and downstream properties and waterways will not be negatively impacted by increased flows. More complex structural flood mitigation measures may involve the construction of structures such as reservoirs, levees, and floodwalls to confine or redelineate the flooding limits. Nonstructural mitigation alternatives include practices such as acquisition or relocation of flood-prone structures, flood-proofing, or implementation of ordinances and codes. Several common types of structural and nonstructural mitigation measures are described below.

5.5.2.1 Structural Flood Mitigation Measures

Structural measures control or contain water and are designed to prevent floodwaters from reaching buildings or property. Structural alternatives include reservoirs, levees and floodwalls, diversions, stream channel conveyance improvements, and drainage and storm sewer improvements. Large or complex structural flood mitigation alternative projects are often costly to implement, so local agencies and private land owners often request help from state or federal agencies such as the IDNR-OWR, the USACE, and the USDA NRCS.

Structural flood control is generally the most expensive type of mitigation measure because of installation time and costs, maintenance requirements, and environmental impacts. Thorough assessment of alternatives prior to selecting a structural flood control measure can minimize costs and impacts. The advantages and disadvantages of structural flood control techniques are discussed in Table 5-4 (Association of State Floodplain Managers, 2007).

Table 5-4: Benefits and drawbacks to structural flood control measures

ADVANTAGES	SHORTCOMINGS
May provide the greatest amount of protection for land area used.	They disturb the land and disrupt natural water flow, often destroying wildlife habitat.
Because of land limitations, may be the only practical solution in some circumstances.	They require regular maintenance, which if neglected, can have disastrous consequences.
Can incorporate other benefits into structural project design such as water supply and recreational uses.	They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
Regional detention may be more cost efficient and effective than requiring numerous small detention basins.	They can create a false sense of security, as people protected by a project often believe the structure eliminates any flooding risk.
	Although it may be unintended, in many circumstances they promote more intensive land use and development in the floodplain.
	They can create new flooding problems if improperly designed or built.
	Levees and reservoirs can significantly degrade riparian and aquatic habitat and water quality.

5.5.2.1.1 Reservoirs and Regional Detention

Reservoirs and regional detention are large structures that control flooding by holding water behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that is equal to or less than the capacity of the downstream channel. Reservoirs that maintain a normal water level may be used for water supply or to provide water-based recreational benefits. Additionally, wet or dry detention basins can serve multiple uses by doubling as parks or other open space uses.

Figure 5-12: Flood control reservoir

The amount of land needed, coupled with the expense of construction, management, and maintenance, limit the use of reservoirs. Additionally, reservoirs may fail to prevent floods that exceed their design levels, eliminate the natural and beneficial functions of the floodplain, and negatively impact water quality and aquatic habitat. Figure 5-12 shows an example of a flood control reservoir.

5.5.2.1.2 Detention Basins

Some localized flooding problems can be minimized by enlarging or adjusting flows through existing detention basins or by constructing new basins. Detention basins are effective at flood reduction in watersheds of up to 30 square miles. While regional detention is generally more cost-effective than constructing numerous small detention facilities, in some cases there may not be sufficient land available for regional detention. Smaller detention basins may be the most cost-effective solution for localized flood problems. Slowing release rates from new and existing detention basins can reduce the downstream flood risk and impacts of short duration-high-velocity events on the stream channel. Retrofitting older detention basins to improve functionality or storage volume or constructing new detention basins are often viable flood mitigation alternatives, especially for smaller tributary areas (less than 100 acres).

5.5.2.1.3 Levees and Floodwalls

Earthen levees or concrete floodwalls are constructed between rivers and at-risk properties to mitigate overbank flooding. Levees and floodwalls confine water to the stream channel by artificially raising the banks (Figure 5-13). Regulatory levees must meet very strict and onerous design and permitting requirements. A serious concern with levees is that they frequently offer a false sense of security. In some cases, land use behind a levee can change to high intensity, high-value occupation under the false assumption that all future floods will be controlled by the levee, when in reality, large floods may overtop or breach the levee creating more flood damage than would have occurred.

Figure 5-13: Floodwall example

Levees and floodwalls have other limitations. Placed along the river or stream edge, they degrade riparian and aquatic habitat. Levees are expensive to construct, require considerable land and maintenance, and are more likely to push floodwater onto other properties upstream or downstream. In some cases, it may be necessary to include expensive and noisy pumping operations for internal drainage. Levees also act as barriers to river access, block views, and disrupt local drainage patterns.

5.5.2.1.4 Barriers

Constructing barriers such as nonregulatory low floodwalls and berms around an individual property can keep floodwaters from reaching the structure. Berms are commonly used in areas subject to shallow flooding; see Figure 5-14 for a diagram of a backyard berm. Not considered engineered structures, berms are made by regrading or filling an area. Low floodwalls may be built around stairwells to protect the basements and lower floors of structures. By keeping water away from the structure walls, the problems of seepage and hydrostatic pressure are reduced. Barriers are commonly referred to as nonregulatory since a barrier typically cannot be used to remove a structure or property from the Regulatory Floodplain.

Figure 5-14: Example of a backyard berm
Diagram Courtesy of Seattle Public Utilities (Seattle.gov)

As with levees, the use of low floodwalls and berms must also include a plan to install drainpipes or sump pumps to handle leaks and water seepage through or under the barrier, and to remove water that may collect within the barrier. Care must be taken in the design, location, and installation of low floodwalls or berms to ensure that flood waters are not inadvertently pushed onto adjacent properties.

5.5.2.1.5 Improved Channel Conveyance

Channel conveyance improvements alter channels to increase drainage rate and volume. Improvements include making channels wider, deeper, smoother, or straighter. Some channels in urban areas have also been lined with concrete or put in underground pipes. Channel conveyance improvements such as channelization and dredging are environmentally destructive with respect to habitat and water quality and are frequently unsustainable.

Straightening, deepening, or widening a stream or river channel, commonly referred to as channelization, has been traditionally utilized to reduce riverine overbank flooding problems. Channelized rivers and streams drain water faster from areas adjacent to and upstream of the channel but can increase or create new flooding problems downstream as larger volumes of water are transported at a faster rate. Channelized waterways tend to be less stable and more susceptible to streambank erosion; therefore, the need for periodic reconstruction, streambank stabilization, and silt removal becomes cyclic, making stream and channel maintenance extremely expensive.

Dredging is another type of conveyance improvement; however, it is frequently cost prohibitive due to dredged material disposal costs. Additionally, dredged areas typically fill in relatively quickly if upstream erosion is not reduced.

5.5.2.1.6 Drainage Improvements

Drainage improvements can include open ditches, swales, or storm sewers. Man-made ditches and storm sewers help drain areas where surface drainage is inadequate or where underground drainageways may be safer or more practical. Drainage and storm sewer improvements can be a quick and relatively cost-effective way to safely convey runoff for a wide range of smaller storm events. Storm sewer improvements may include the installation of new sewer lines or inlets, modifications to existing sewer inlets, installation of larger pipes, construction of better defined or more effective overland flow routes, and the use of mechanical measures, such as pumps or backflow preventers. Since drainage improvements typically result in runoff being more efficiently conveyed to a downstream location, these mitigation measures should only be used when the receiving waterway has sufficient capacity to handle the additional volume and flow of water. To prevent cumulative downstream flood impacts, drainage improvements are often combined with other storage volume creation or runoff reduction measures.

Performing regular maintenance on stormwater infrastructure for drainage improvements, such as channel clearing, dredging, storm sewer cleaning, or clogged debris removal, can be the most cost-effective measure in reducing future larger, more expensive infrastructure problems. “All stormwater management systems, whether gray or green, require maintenance. Appropriate operation and maintenance activities ensure that green (and gray) infrastructure will continue to function properly and yield expected water quality and environmental benefits, protect public safety, meet legal standards, and protect communities’ financial investment.” (U.S. Environmental Protection Agency - Office of Water, 2013).

5.5.2.2 Nonstructural Flood Mitigation Measures

Flooding problems can also be addressed using nonstructural methods. Nonstructural flood control techniques include flood-proofing, and elevation or relocation of a structure. More communities and county-wide agencies could get involved in nonstructural programs such as acquisition by helping to identify repetitively flooded properties. Runoff reduction techniques may also be used by individual homeowners or neighborhood associations in retrofit projects to lessen flooding problems.

5.5.2.2.1 Buyouts and Acquisitions

Acquisition ensures that structures in a flood-prone area will cease to be subject to flood damage. The major difference is that acquisition is undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to an appropriate permanent public use such as a park. Acquiring and clearing structures from the floodplain is the best long-term flood protection measure, one which converts a problem area into a community asset that can provide environmental and recreational benefits. To achieve maximum benefits from this type of public investment, acquisition and land reuse should be a component of a community's redevelopment plan, and be incorporated as a strategy in park, greenways, and capital improvement plans. See Figure 5-15 for before and after photos of the Gurnee Grade School (Gurnee, Illinois) flood buyout location.

Figure 5-15: 2013 Gurnee Grade School flood mitigation site during flood events
Before buyout looking south (top); after buyout and school removed looking north (bottom)
"X" is the same spot on the site location

5.5.2.2.2 Structure Relocation

Moving a structure to higher ground is an extremely effective way to protect it from flooding. In many cases structure relocation is cost prohibitive because of the size, condition, and type of structure and the cost of acquiring a relocation site. Structure relocation can be cost effective where flooding is relatively severe or frequent. Structure relocations have high initial costs, but they may be more cost-efficient than paying for repetitive flood damages or high flood insurance premiums. Relocation is typically the responsibility of the structure owner; however, government-sponsored loans or grants may be available for cost-share.

5.5.2.2.3 Structure Elevation

Raising a structure above the floodplain elevation is the best way to protect a structure that cannot be removed from the floodplain. The structure is elevated on a foundation or piers so that the lowest floor is above the BFE. When flooding occurs, water levels stay below the main floor, causing minimal damage to the structure or its contents. Raising a structure above the flood level is less expensive than moving it and can be less disruptive to a neighborhood. Commonly practiced in flood-prone areas nationwide, this protection technique is required by law for new and substantially damaged residences located in a 100-year floodplain.

Although flood damages can be reduced or eliminated through structure elevation, remaining in a flood-prone location has some limitations. While the structure itself is sufficiently elevated to be protected from flood damage, flooding may isolate the building and make it inaccessible. Flood waters surrounding the structure can also result in a loss of utility service or septic use, making the structure uninhabitable. Additionally, pollutant contamination in flood waters may present health and safety concerns.

5.5.2.2.4 Flood Proofing

Flood-proofing measures include dry flood-proofing or wet flood-proofing. In areas where there is shallow flooding, dry flood-proofing measures can be used to prevent water from entering at-risk structures. Dry flood-proofing is a combination of practices that are used to make a building watertight, so flood waters do not enter the structure, including the basement or crawl space. Various FEMA and the USACE publications highlight the range of practices that can be used to dry flood-proof a structure. Figure 5-16 shows an example of dry flood proofing practices.

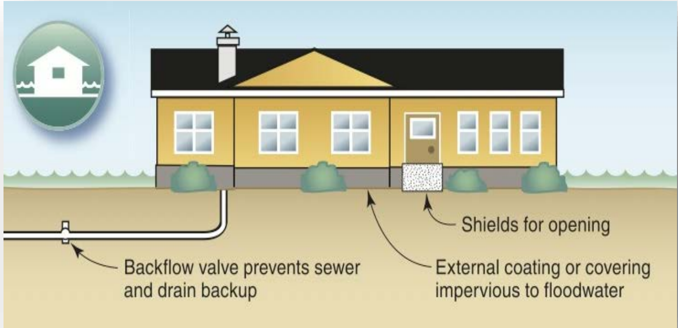


Figure 5-16: Dry flood-proofing

As defined by FEMA, wet flood-proofing includes permanent or contingent measures applied to a structure or its contents that prevent or provide resistance to damage from flooding while allowing flood waters to enter the structure or area. Wet flood-proofing allows water to enter the structure, but minimizes the damage to the structure and its contents. Wet flood-proofing includes some of the least expensive and easiest mitigation practices to install. Generally, this includes properly anchoring the structure, using flood resistant materials below the BFE, protecting mechanical and utility equipment, and using openings or breakaway walls. Several low-cost steps can be taken to wet floodproof a structure. For example, simply moving furniture and electrical appliances out of the flood-prone portions of the structure can prevent thousands of dollars in damages. One strong advantage of wet flood-proofing is that flood damage can be reduced through some common sense, low or no-cost practices. Figure 5-17 shows an example of wet flood proofing practices.

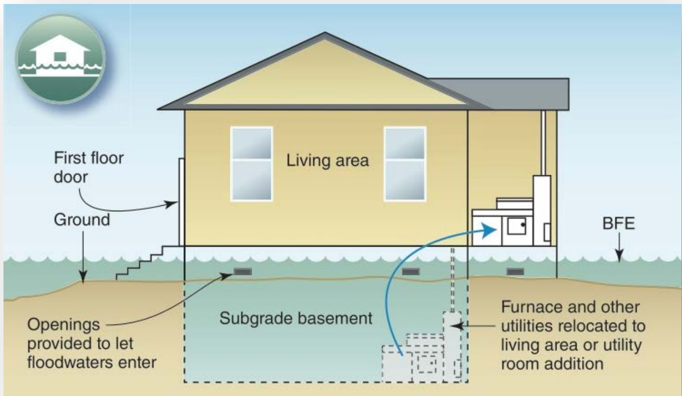


Figure 5-17: Wet flood-proofing

5.5.2.2.5 Runoff Reduction

Examples of runoff reduction techniques include the use of natural landscaping, permeable pavement, rain gardens and green roofs. Implementing these runoff reduction retrofits is generally the responsibility of individual property owners. These techniques typically do not have a substantial impact when applied on a single site; however, the cumulative effect of runoff reduction techniques at numerous sites throughout the watershed can result in substantial flood reduction benefits. The large scale of individual implementation required to achieve measurable flood reduction benefits makes this flood mitigation measure a long-term complementary mitigation measure rather than an immediate flood mitigation alternative.

5.5.3 ALL-NATURAL HAZARDS MITIGATION PLAN RECOMMENDATIONS

The DPR planning area is subject to natural hazards that potentially threaten life and property. Flooding, severe summer and winter storms, extreme cold and heat, and tornadoes are the most significant natural hazards that affect Lake County (including the DPR planning area).

To prepare for and mitigate the effects of natural hazards, counties within the DPR watershed have developed hazard mitigation plans. FEMA, through the Disaster Mitigation Act of 2000 (DMA 2000) and the Stafford Act, requires that each community develop and adopt a FEMA-approved All-Natural Hazards Mitigation Plan (ANHMP) in order to be eligible for hazard mitigation grant funds. DMA 2000 and the Stafford Act require that the mitigation ANHMP be updated and readopted every five years to maintain grant eligibility. An ANHMP assesses the natural hazards that affect counties, sets mitigation goals, considers mitigation efforts currently being implemented, evaluates additional mitigation strategies, and recommends mitigation actions to be implemented over the next five years. The mitigation actions are designed to utilize both public and private sectors to protect the people and assets of the counties. Implementation of all action items is contingent on the availability of staff and funding.

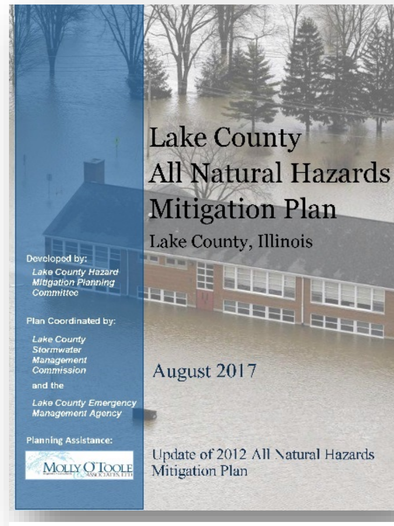


Figure 5-18: 2017 ANHMP

Lake County and the hazard mitigation planning committee (HMPC) developed and adopted the Lake County Countywide ANHMP in 2006 as a multi-jurisdictional plan; the plan was updated in 2012 and 2017 (see Figure 5-18).The 2017 update to the ANHMP was developed by the Lake County HMPC as a multi-jurisdictional ANHMP to meet federal mitigation planning requirements. The 2017 ANHMP is adopted by resolution by the County and each participating municipality. The 2017 ANHMP will be implemented and maintained through both countywide and individual initiatives, as funding and resources become available.

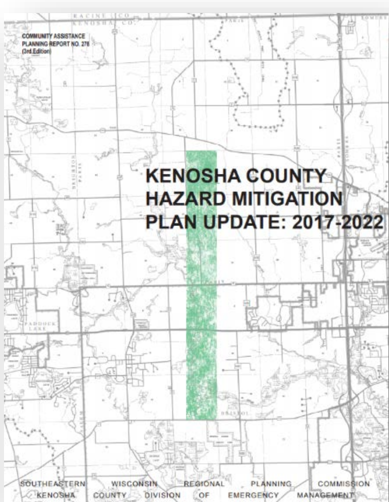
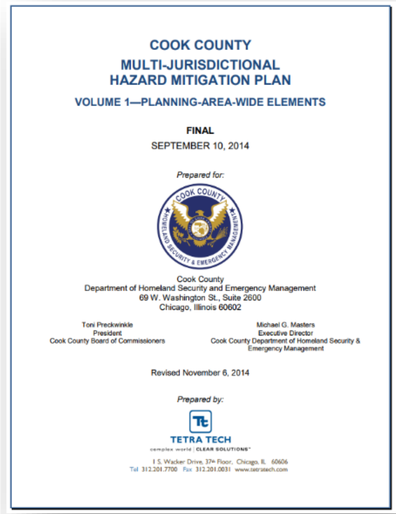


Figure 5-19: Kenosha County ANHMP

SEWRPC and the Kenosha County Division of Emergency Management cooperatively developed the Kenosha County ANHMP in 2005 (Figure 5-19); the plan was updated in 2009 and 2017. The plan follows the guidelines and requirements of the Wisconsin Department of Military Affairs, Division of Emergency Management, and FEMA. The plan was written with the guidance of the Kenosha County Hazard Mitigation Task Force. The plan has been adopted and approved by Kenosha County and the municipalities within the county.

The Cook County Department of Homeland Security and Emergency Management developed the Cook County Multi-Jurisdictional Hazard Mitigation Plan (Figure 5-20) in 2014 with guidance from a steering committee comprised of planning partners and local stakeholders. The plan was developed under a grant from the IEMA in coordination with 115 planning partners and is the largest multijurisdictional all hazards mitigation plan ever completed in the United States. That plan incorporated existing local and state plans, studies, reports, and technical information.


COOK COUNTY
MULTI-JURISDICTIONAL
HAZARD MITIGATION PLAN
VOLUME 1—PLANNING-AREA-WIDE ELEMENTS
FINAL
SEPTEMBER 10, 2014
Prepared for:
Cook County
Department of Homeland Security and Emergency Management
69 W. Washington St., Suite 2600
Chicago, Illinois 60602
Toni Preckwinkle
President
Cook County Board of Commissioners
Michael G. Masters
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Cook County Department of Homeland Security & Emergency Management
Revised November 6, 2014
Prepared by:
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Figure 5-20: Cook County ANHMP

5.6 EXISTING AND POTENTIAL REGIONAL FLOOD STORAGE

5.6.1 Existing Flood Storage

Existing flood storage is defined as depressional areas and floodplains that are presently storing, or potentially could store, stormwater runoff to decrease flooding in the watershed. Besides flood protection, flood storage areas can be used for the mitigation of wetland losses (wetland restoration), channel protection, and water quality protection. Flooding is a common problem in the DPR planning area. Creating or enhancing storage would provide many benefits including reducing runoff to streams and minimizing channel erosion. Storage areas that are created through wetland restoration would improve water quality and habitat and increase groundwater recharge. The criteria used to identify existing storage locations are:

Figure 5-21: Wetland with high flood storage

- Include all mapped FEMA 100-year floodplains (SFHA), wetlands with high flood storage function (as identified in the WRAPP), detention basins, and open water areas (Example Figure 5-21).
- Minimum storage size of 1 acre-foot on partially open or open parcels.
- Includes stream corridors.

The existing flood storage locations are identified in Figure 5-22**.** These locations range from 1-5,084 acre-feet of storage with a median storage of 4 acre-feet. The total of 1,931 storage areas encompass 24,219 acres (16% of the DPR planning area) with an estimated potential to store a total of 50,348 acre-feet of water.

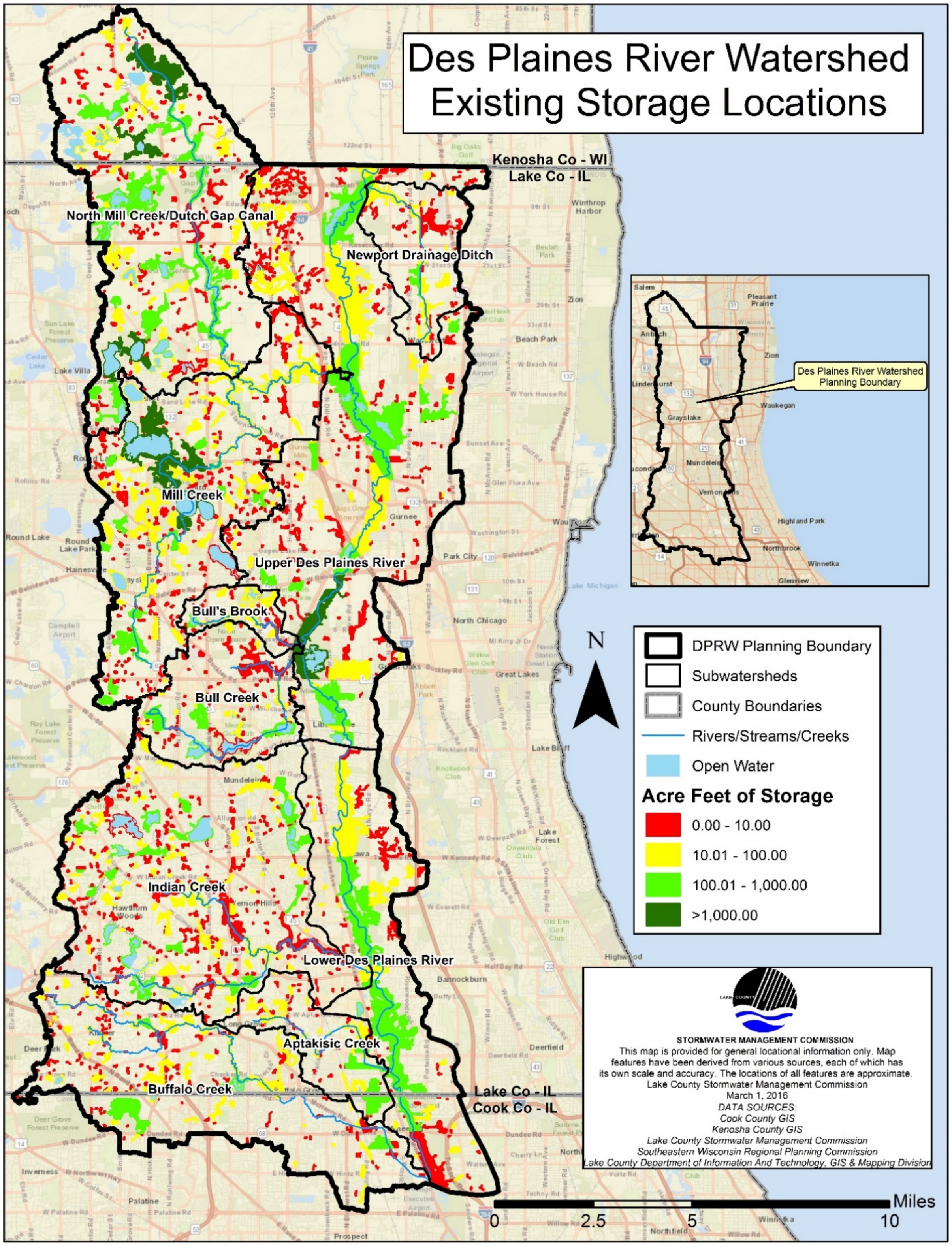


Figure 5-22: Des Plaines River Watershed Existing regional flood storage

5.6.2 Regional Storage Analysis

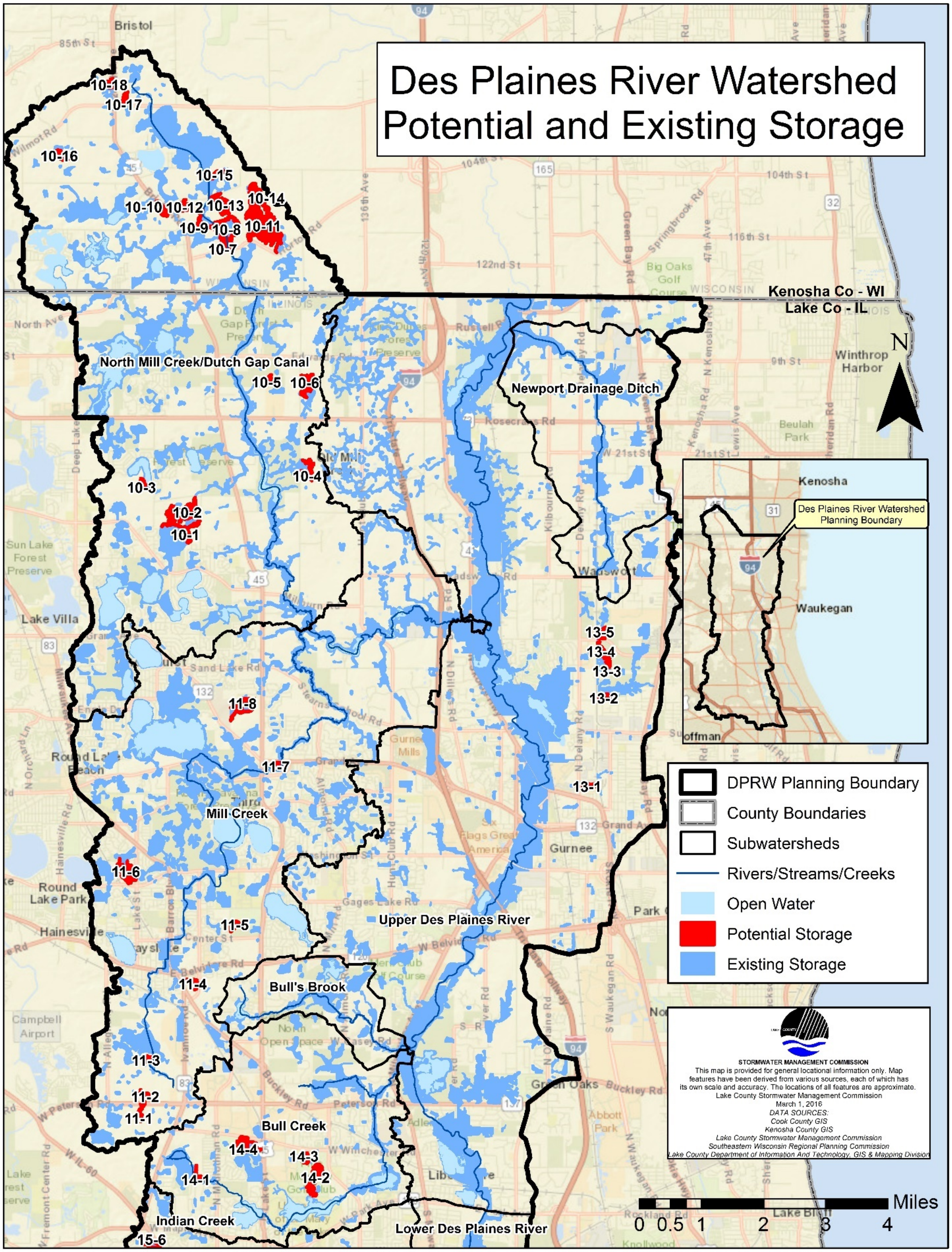
A GIS analysis of the watershed was performed to identify potential regional storage locations. Regional storage locations are depressional areas in the watershed that are within open space land use and are not currently classified as large lakes or large wetland complexes. Identified regional storage locations met the following criteria:

- Locations greater than 5 acres in size
- At least 100 acres of tributary drainage area
- Excludes existing flood storage locations
- Excludes building and transportation footprints on open and partially open parcels
- Not an existing WRAPP wetland

Sites meeting the above criteria were visually screened to eliminate artifacts of the GIS analysis and locations where site characteristics would impede creation of additional storage. Fifty-three sites with a total potential storage of 1,485 acre-feet of storage were identified based on the regional storage criteria defined above and additional screening (Table 5-5 and Figure 5-23). Chapter 6 further details implementation actions regarding the identified potential regional storage locations.

Table 5-5: Potential Regional Flood Storage Sites

SITE ID	SUBWATERSHED	ESTIMATED POTENTIAL STORAGE (ACRE-FEET)	SITE ID	SUBWATERSHED	ESTIMATED POTENTIAL STORAGE (ACRE-FEET)
10-1	North Mill Creek	19.80	13-2	Upper Des Plaines River	48.91
10-2	North Mill Creek	100.05	13-3	Upper Des Plaines River	19.81
10-3	North Mill Creek	17.56	13-4	Upper Des Plaines River	38.66
10-4	North Mill Creek	8.28	13-5	Upper Des Plaines River	27.77
10-5	North Mill Creek	3.42	14-1	Bull Creek	17.39
10-6	North Mill Creek	45.28	14-2	Bull Creek	44.62
10-7	North Mill Creek	9.47	14-3	Bull Creek	13.54
10-8	North Mill Creek	19.55	14-4	Bull Creek	123.41
10-9	North Mill Creek	8.80	15-1	Indian Creek	16.14
10-10	North Mill Creek	6.09	15-2	Indian Creek	7.43
10-11	North Mill Creek	170.65	15-3	Indian Creek	90.01
10-12	North Mill Creek	9.98	15-4	Indian Creek	19.09
10-13	North Mill Creek	39.68	15-5	Indian Creek	68.90
10-14	North Mill Creek	22.27	15-6	Indian Creek	42.39
10-15	North Mill Creek	4.91	16-1	Lower Des Plaines River	42.61
10-16	North Mill Creek	7.33	17-1	Buffalo Creek	24.13
10-17	North Mill Creek	19.24	17-2	Buffalo Creek	11.01
10-18	North Mill Creek	7.10	17-3	Buffalo Creek	6.16
11-1	Mill Creek	18.57	17-4	Buffalo Creek	13.30
11-2	Mill Creek	13.90	17-5	Buffalo Creek	6.27
11-3	Mill Creek	5.65	18-1	Aptakisic Creek	21.55
11-4	Mill Creek	12.18	18-2	Aptakisic Creek	42.42
11-5	Mill Creek	20.94	18-3	Aptakisic Creek	10.13
11-6	Mill Creek	55.75	18-4	Aptakisic Creek	6.47
11-7	Mill Creek	23.01	18-5	Aptakisic Creek	11.55
11-8	Mill Creek	22.98	18-6	Aptakisic Creek	6.84
13-1	Upper Des Plaines River	12.01	TOTAL ESTIMATED POTENTIAL STORAGE		1,484.96


Des Plaines River Watershed
Potential and Existing Storage
DPRW Planning Boundary
County Boundaries
Subwatersheds
Rivers/Streams/Creeks
Open Water
Potential Storage
Existing Storage
Kenosha Co - WI
Lake Co - IL
North Mill Creek/Dutch Gap Canal
Newport Drainage Ditch
Mill Creek
Upper Des Plaines River
Bull's Brook
Bull Creek
Indian Creek
Lower Des Plaines River
10-18
10-17
10-16
10-15
10-14
10-13
10-12
10-11
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14-4
14-3
14-2
14-1
15-6
Kenosha
Des Plaines River Watershed Planning Boundary
Waukegan
Bristol
Winthrop Harbor
Gurnee
Round Lake Park
Lake Villa
STORMWATER MANAGEMENT COMMISSION
This map is provided for general locational information only. Map features have been derived from various sources, each of which has its own scale and accuracy. The locations of all features are approximate.
Lake County Stormwater Management Commission
March 1, 2016
DATA SOURCES:
Cook County GIS
Kenosha County GIS
Lake County Stormwater Management Commission
Southeastern Wisconsin Regional Planning Commission
Lake County Department of Information And Technology, GIS & Mapping Division
Miles
0 0.5 1 2 3 4

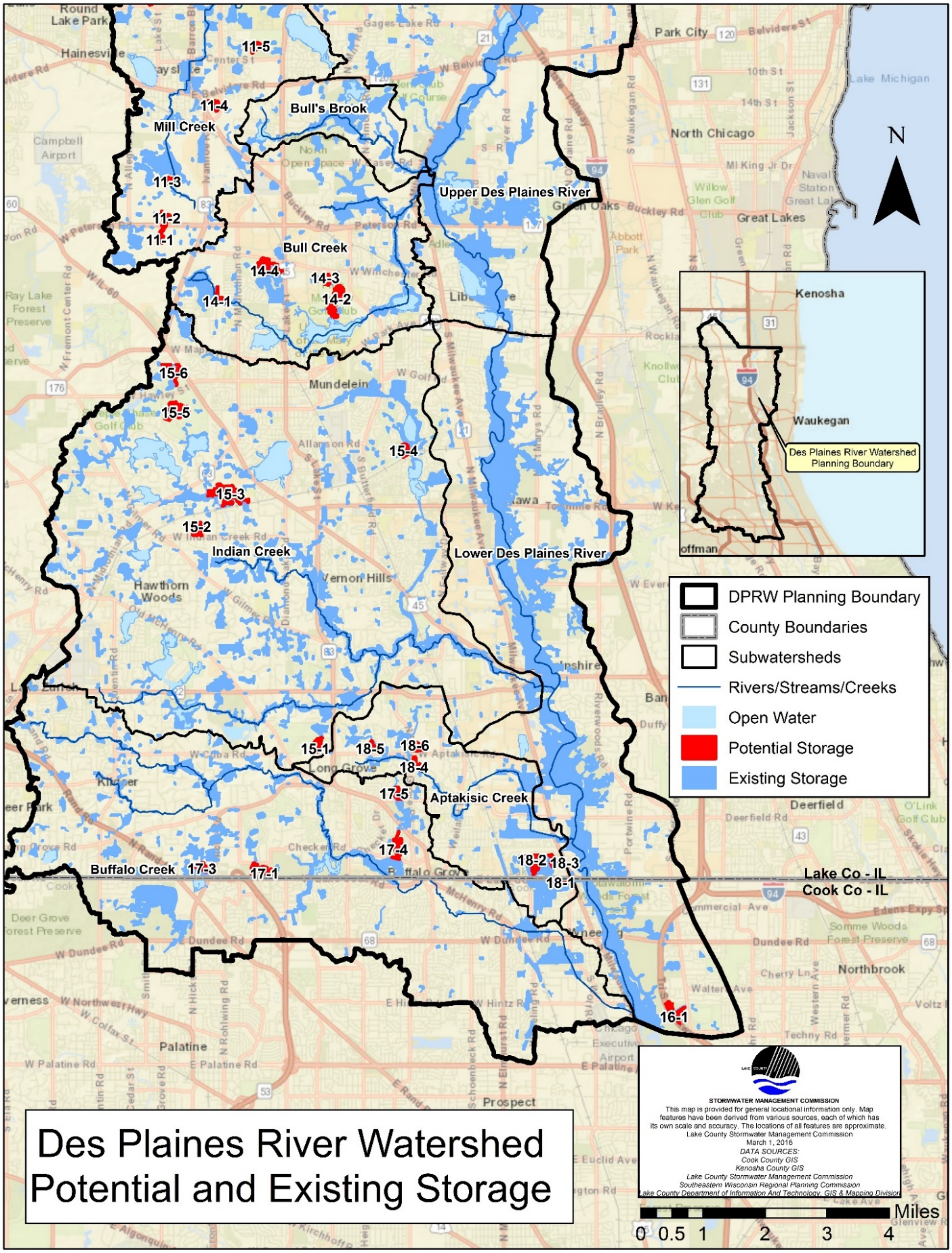

Figure 5-23: Des Plaines River Watershed potential and existing regional flood storage

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